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CADDISWORMS (TRICHOPTERA) AS IDEAL INDICATOR ORGANISMS FOR RESPIRATIONAL STUDIES OF SMALL ANIMALS.*

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For a number of years, a line has been drawn between animals which merely live in water but obtain atmospheric air for respiration, and those truly aquatic forms which depend upon oxygen removed from solution in the water surrounding them. In making a study of the latter type of organisms, we recently noted that there are two distinct methods of respiration correlated with rate of blood circulation.

We might recognize three main categories of truly aquatic organisms. Firstly, there are those of small size or with a soft integument, whose respiration is frequently a simple function of unspecialized epidermis, so that no gills or similar structures are needed. Secondly, there are those of larger size or with an exoskeleton, which have always been, so far as we know, inhabitants of bodies of water (larger Crustacea exclusive of Isopoda, echinoderms, many molluscs, the protochordates, cyclostomes and fish, and immature amphibians). Thirdly, there are those now truly aquatic but belonging to groups of animals which were at some time terrestrial, i.e. the secondarily aquatic organisms. To this last category belong the aquatic isopods, the larvae of many orders of insects, and a few mites.

Among the primarily aquatic organisms (those of the second category above), normal metabolism is accompanied by relatively rapid movement of blood throughout the body. There are usually well developed gills with a circulation through them of fluid to be aerated, the blood separated from the water around the filaments of the gills by only a very thin layer of tissue. With this system, air dissolved in the water passes through the membrane of the gill filament, enters the vascular fluid, and is then pumped to all parts of the body.

The secondarily aquatic organisms (those of the third category) usually have a very slow circulation of the internal transport medium. Paralleling this difference in rate of vascular activity is a difference in the method of removing air from the water. Many structures resembling gills have been described for these organisms, but few except true tracheal gills involving air tubes have a proven respiratory significance. That the "blood" gills and other organs were not connected primarily with oxygen absorption was first demonstrated in 1924 by Ege, Fox, Wigglesworth and others, using various techniques. Since then, several investigators have added data involving many other groups of animals.

There have been a number of modes of attack upon the problem, some involving amputation of suspected respiratory structures, others using dyes and

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colorimetric indicators, still others using a more refined method, employing luminous bacteria and protozoans to indicate a given oxygen or carbon dioxide tension in the water surrounding the organism studied. This last is such a pretty method, and one so little attempted in North America, that it may be well to mention here its main features.

In a dark room, a specimen of the animal to be examined is carefully lowered into a rich culture of the bacteria or protozoa, under a low power microscope. As the animal respires, it uses up the oxygen in it vicinity, and the lowered oxygen tension finally reaches a critical value where the micro-organisms in the culture solution are stimulated to luminesce. The water in contact with the animal then glows. As more oxygen diffuses in and is used up in respiration, the micro-organisms more remote from the animal studied are excited and become luminous. Meanwhile, those first stimulated have passed beyond the critical tension and are no longer visible. Consequently, a ring of luminous micro-organisms is seen around the central specimen, the ring gradually increased in size as time goes on and more of the dissolved oxygen in the dish is used up. If any part of the specimen's body be respiring more rapidly than any other (i.e. if there be gill structures which are taking care of the body's respiration), the oxygen in that vicinity will be used up more rapidly, and the function of the structure shown by the disproportionate widening of the luminous ring in that region. In methods which use micro-organisms reacting to the carbon dioxide given off by the respiring animal, a similar phenomenon is observed, the rate recorded, and any irregularities in the development of the luminous ring noted. In this type of experiment, only a very few aquatic animals of the third category have been shown to have special respiratory structures, the whole integument (or in sclerotized forms, the intersegmental membranes) being responsible for all gas changes of this sort.

Since this is the case, it would be expected that the secondarily aquatic animals have respiratory problems peculiar to them, not affecting the primarily aquatic forms in the same degree. As we consider larger and larger animals of this third category, there must be some absolute size above which it would be so difficult for the organism to get adequate oxygen through the integument by diffusion to satisfy the metabolic needs of its larger bulk, that interesting mechanisms for increasing the amount of air available to that integument would be found. It might be expected that peculiar habits or restriction in habitat or in tolerances would be noticeable. These expectations depend, of course, on the mathematical truth that in any given shape, the surface of the body increases only as the square of the length, while the bulk (and hence metabolizing cells) increases as the cube of the length.

Since the shape of the object compared must be kept similar for this relation to be true, we must compare organisms of the same general form. For such physiological investigations as those concerning respiration, it would also be desirable that the species studied be rather closely related, e.g. be members of the same order. In this way, we could confidently compare smaller with larger species, earlier with later instars. It would also be ideal to find some order of animals which had representatives of the same general body form in

all of the aquatic habitats. Since we recognize a large number of such habitats, this is a difficult stipulation. We want an organism which has close relatives in deep sea, shallow sea, tidal flats, brackish ponds, slow and sluggish streams of various mineral content, faster streams, rushing rivers, torrents, deep and shallow lakes, acid bogs, wet moss and thermal springs. So far as we are aware, the group of animals which best fits the above demands is the Trichoptera, a small order of insects, the larvae (caddisworms) of which have representatives in the Gulf of Finland (a shallow sea), in tidal flats (Australian species which construct cases of seaweeds), brackish ponds (many European genera have shown invasion of these habitats), slow streams, faster rivers, rapids, torrents, even waterfalls, deep cold lakes (up to 60 meters) and shallow warm ones, wet moss (one species) and thermal springs (many species, mostly Limnephilidae).

The most satisfactory place in which to study respiration of any animal is the laboratory, where many more factors can be controlled than in the field. It is a task to provide natural conditions of life for caddisworms living in an aquarium tank. With the pond and slow stream species, it seemed easy. With fast stream species, it seemed impossible. Larvae from rapid rivers died within a few minutes, apparently asphyxiated. If kept on ice or at a very low temperature, they lived but did not develop, merely existed until some other factor caused their death. It became necessary to carefully analyse the respiratory cycle and see what portions of it could be modified in vitro, and which might be different in an aquarium tank full of river water from in the river itself. We listed these steps in the respiratory cycle of a small aquatic animal with slow blood circulation: 1. Diffusion of oxygen into the medium surrounding the animal; 2. Diffusion of oxygen through the medium from the air to the animal (dependent upon depth, water movement, temperature, etc.); 3. Diffusion of oxygen through the integument of the animal (dependent upon the nature of the integument); 4. Transport of the oxygen from the site of entry into the organism to the metabolizing cells and tissues; 5. The animal's own metabolic rate; 6. Transport of carbon dioxide from the metabolizing tissues to the integument; 7. Diffusion of carbon dioxide through the animal's integument; 8. Diffusion of carbon dioxide away from the animal (dependent upon chemicals in the water, water movement, temperature, etc.); and 9. Diffusion of carbon dioxide into the air over the water. Of these, numbers 7 to 9 were presumably rapid, since the water was usually clear and pure, and circulation could be maintained by means of a mechanical stirrer. Decreasing the temperature affected the animal's own metabolic rate more than any of the other factors, but the reduction in anabolic activity nullified any gain in reduction of catabolic respiration. Increase in partial pressure of oxygen in the air over the tank could have been tried but was not.

It was noted however, that animals from fast streams lived longer in water not more than two millimeters deep than in water fifteen centimeters deep. This made us look to the air supply of the tanks. We tried bubbling air through the water; it helped. Then a friend showed us a Berkfeld bacteriological filter ("candle"), used for removing filterable from non-filterable bacteria. We tried sinking these candles in fifteen centimeters depth of water in an aquarium and

blowing air into the candle at about half an atmosphere pressure. Extremely fine air bubbles came out at great speed. Many of them dissolved immediately. Others disappeared before they rose to the surface of the tank. Still others became attached to the sides of the tank, to the caddisworms, to the plants in the tank, etc., and thoroughly supercharged the water with air. But the animals which had been dying one after another lived. Indeed, the caddisworms metamorphosed,—and did so even sooner than their brothers in the streams. We tried it on other caddiworms, and they did well. Other small aquatic animals with slow blood circulation thrived in it. We tried the method on crayfish and guppies. Both died in convulsions. Apparently the air which dissolved in their blood came out of the supercharged condition and blocked blood flow in their circulatory systems. Blood flow was essential to their metabolism; occluding the vessels with bubbles caused their death. Not so the caddis worms. Their blood flow was so sluggish as to be unimportant, their capillaries negligible in extent, so that they lived happily, with increased vigor. This, we feel, is a technique worth following farther.

We have noted that caddisworms from swift streams living in water supercharged with air in this way (using a style N Berkfeld bacteriological filter to each half liter of water fifteen centimeters deep), are much more tolerant of high temperatures, prolonged starvation and intense insolation, than are caddisworms from ponds and slow streams living under corresponding conditions. Other interesting observations can doubtless be made on other tolerances of stream species, now that they can be successfully reared in vitro. The Trichoptera are an ideal group in which to study respiration because of the uniformity of body structure, and their invasion of many habitats. All may now be studied in laboratory aquaria.

SUMMARY

Many morphological structures connected with the skin of small aquatic invertebrate animals were formerly described as "Gills" for respiratory activity. Recent work has shown many of these structures to be wholly concerned with maintenance of satisfactory water relations within the body cavity and excretory organs. In such animals, respiration takes place directly through the skin. With growth, the bulk of the animal (hence metabolizing cells) increases more rapidly than the surface (respiratory areas). Alterations in permeability relations, in habits and in toleration for habitats of low oxygen availability, are thus to be expected where growth is rapid, or where there is a large size difference between younger and older stages of the animal. Further modifications of the respiratory problem are linked with movements of the water bearing the oxygen. Deep sea, shallow sea, tidal zone, tide flat, slow stream, swift stream, torrent, damp moss and deep lake, all present differences which are reflected in the respiratory mechanism. The insect order Trichoptera occupies more of these niches than any other group of small aquatic invertebrate metazoans, yet the morphological structure of the larvae is surprisingly uniform. Interesting variation has been found in the habits and tolerance of the forms occupying these various niches, and new techniques have been developed for studying them in vitro.

THE BEES OF ALBERTA VI.

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Andrena bryanti n. sp.

Female. Length about 13 mm, anterior wing 10 mm.; black, robust, the head and thorax with long very pale ochreous-tinted hair, the hind part of mesopleura with a small amount of inconspicuous dark hair; flagellum dark chestnut-red beneath; third antennal joint about as long as the next two combined; face broad; clypeus evenly convex, without a median ridge, the strong punctures rather regularly arranged, often in rows, on a shining surface; process of labrum large and very broadly rounded; facial fovae broad, seal-brown, extending somewhat below level of antennae, separated from eye by a shining line; mesothorax shining on disc, with very minute punctures; scutellum dull, it and the postscutellum densely covered with long hair; metathorax very hairy, the exposed basal area small, triangular, with a dull surface; tegulae dark reddish brown; wings strongly reddish-brown, the stigma large, dull ferruginous, nervures brown; basal nervure falling short of nervulus; second cubital cell much broadened below, receiving recurrent nervure about middle; third cubital cell about as broad on marginal as second; legs more or less rufescent, especially the femora, their pubescence (including tibial scopa) mainly black, but front and hind femora with long white hair; abdomen shining, bandless, the punctures excessively minute, the hind margin of the fourth tergite pallid; apical hair black; ventral segments with long black fringes.

Alberta: Ponoka, June 12, 1921 (Owen Bryant). This is the type but there is another from Beaverlodge, 1933 (I. C. Shank). The type was long ago submitted to Viereck, who did not know the species, but labelled it "near *lupinorum.*" In my key to the group *A. vicina,* it falls near *A. regularis* Malloch, *A. argentiniae* Ckll. and *A. lupinorum* Ckll. It appears at first sight to be *A. argentiniae,* but is certainly distinct by the dullish second tergite with hardly visible punctures (in *argentiniae* it is shining and distinctly punctured), and the conspicuously larger stigma. By these characters it also differs from *A. lupinorum,* which further differs in the colour of the pubescence. It differs from *A. regularis* by having much less black hair, but it seems to be closely allied, perhaps to be regarded as a western representative of this species. Malloch's description of female *A. regularis* is too brief, but Miss Grace Sandhouse has kindly supplied the following additional details from a paratype:

Process of labrum rounded (not at all truncate as in *A. carlini*), and the fringe of hairs is distinctly reddish, not black; clypeus with no smooth line or ridge, the depressed apical margin narrower than in *A. carlini,* especially in the middle, the punctures are small, shallow, and separated by at least four times the diameter of a puncture; hair at sides of propodeum light; in the second cubital cell the proportions are, second transverse-cubital 3, upper region of cell 4, lower margin about 5.5; punctures of tergites finer than in *A. carlini,* apical margins of tergites a little lighter, especially medially, but just brownish, not at all testaceous.

A. regularis was found at Ithaca N.Y., April 26 to June 6.

A specimen of *A. bryanti* from Edmonton, June 2 (Strickland) was at first set aside as distinct, being smaller (length about 11.5 mm), with the flagellum only very obscurely brownish beneath, and the patch of black hair on lower part of mesopleura large and conspicuous, while the second cubital cell is greatly narrowed above, only about half as broad on margin as the third. This may be no more than an individual variation.

Andrena semirufa Cockerell. Females. Bilby, July 4 and 12, 1924 (O.Bryant); Wabamun, June 14, 1936 (Strickland).

This species was described (1900) from a female taken at flowers of *Salix*, Las Vegas Hot Springs, New Mexico, in the spring of 1899. The type is in the U. S. National Museum, but I have a specimen determined by Viereck, and agreeing with the description from Red River Valley, N. M., Aug. 12. This would appear to indicate a second brood. In my original description, I said that the species appeared to be very close to *A. nivalis* Smith. I have a specimen of *A. nivalis* from Milwaukee which I compared with Smith's type (from Hudson Bay) in the British Museum. It is dated May 20. It differs from *A. semirufa* in the narrower, truncate, process of labrum (see also Canad. Entom, May 1901, p. 151), the more hairy postscutellum, and to some extent in the colour of the hair on the legs. Viereck considers *A. nivalis* and *A. semirufa* undoubtedly distinct, but certainly they are extremely closely allied, and should be studied in larger series, from more localities. A specimen from Algonquin, Illinois (Nason), which was sent to me as *A. dunningi* Ckll. (a quite different species), appears inseparable from *A. semirufa*.

Andrena prunorum Ckll., var. **pauperatula** n. var.

Female. Length about 11.7 mm.; black, with the tibiae and tarsi bright red; hind margin of first tergite narrowly red. Compared with the black mutation of *A. prunorum* found at Boulder, Colorado, it differs thus: less robust; hair of head and thorax white; hair at end of abdomen very pale, slightly yellowish; tegulae brown instead of clear red. The area of metathorax is not plicate at base. Hairbands on tergites 2 to 4 clear white. It is considerably smaller than *A. kincaidii* Ckll., with the pubescence quite differently coloured.

Alberta: Lethbridge, Aug. 5, 1935 (E. H. Strickland). Typical *A. prunorum* has been recorded from Lethbridge, May to July, according to a list supplied by Professor Strickland. The present insect has the appearance of being a distinct race, but more material should be seen.

Andrena medionitens Cockerell. Lethbridge, June 12 (Strickland). Two females, a variety with the hair of thorax rich rufofulvous, and the facial fovae reddish. The hind tibiae and tarsi, (but not the others) are clear red. Perhaps a distinct race should be recognized. The species was described (1902) from Pasco, Washington State, but it occurs in Colorado. There is also a specimen of this species from New Dayton, Alberta, June 9, 1925 (Strickland).

Andrena sieverti Cockerell. Lethbridge, June 12, 1933, female (Strickland). Very similar to *A. canadensis* D.T., but easily distinguished by the amber-coloured stigma and the very large exposed area in the middle of the metathorax. It was described (1906) from Florissant, Colorado, alt. about 8000 ft., July 24.

Andrena persimulata Viereck. Gull Lake, June 18 (Strickland). Described from Wisconsin. It is the species which Graenicher regarded as *A. platyparta* Rob.

Andrena wheeleri pallidior n. subsp.

Female. Length about 9 mm., anterior wing slightly over 7; black, with no metallic tints, mandibles reddish apically, flagellum very faintly brownish below; tegulae shining castaneous; wings conspicuously reddish, stigma ferruginous, with a dark border below, nervures dusky reddish; legs black, the tarsi rufescent at end; hind margins of tergites narrowly brown; hair of head and thorax dull white, distinctly yellow on scutellum, postscutellum and metathorax; legs with white hair, ferruginous on inner side of tarsi; abdomen bandless, almost without hair, but at apex with pale fulvescent hair. Head broader than long, but not unusually broad; mandibles with the inner tooth rudimentary; process of labrum broadly rounded; malar space very short, shining; third antennal joint not longer than the next two together, fourth very short; clypeus convex, polished, with well separated punctures, and no median ridge; facial foveae with dull whitish hair, narrow below, much broadened above, so that the foveae converge above; front dull; supraclypeal area dull (a little shining at lower end), constrasting with clypeus: mesothorax and scutellum dullish, very minutely tessellate, with punctures scattered on mesothorax, denser on scutellum; postscutellum with a dense tuft of hair, but area of metathorax exposed, dull and granular; second cubital cell about square, receiving recurrent nervure a little beyond middle; hind tibiae stout, but hardly twice as broad as basitarsus, the hair on their outer face not evidently plumose; abdomen moderately shining, second tergite in middle depressed less than half. Somtimes the posterior disc of mesothorax is polished.

Alberta: Wabamun, eleven (E. H. Strickland). June 13 to July 1. Compared with a Milwaukee specimen of *A. wheeleri* Graenicher, received from Dr. Graenicher, and one which I collected (May 27) at Steamboat Springs, Colorado, this has the hair much less pubescent, and the foveae more evidently converging above. But one collected by Lovell at Waldoboro, Maine, has white hair on head and thorax, and the foveae as in the Alberta form. We may suppose that a distinct race extends from Maine to Alberta in the north. The Maine specimen was taken at flowers of *Sedum acre*, July 12, 1905. True *A. wheeleri* is said by Graenicher to fly in the Milwaukee district from June 8 to June 18, and to be oligotropic on Umbelliferae.

Andrena (*Trachandrena*) *multiplicatiformis* Viereck. Clymont, June 23, 1937, female, (Strickland). Agrees with one from Pequaming, Michigan, July 4, 1903. (Morgan Hebard.).

Andrena (*Trachandrena*) *indotata* Viereck. Edmonton, May 1, 1924, female (Strickland). Agrees with one (determined by Viereck) from Oxbow, Sask., May 1907 (F. Knab.). Described from Corvallis, Oregon.

The holotypes of the new forms described above will be placed in the Canadian National Collection.

FOUR NEW NEARCTIC SPECIES OF FABRICIELLA, (TACHINIDAE, DIPTERA).[1]

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The genus *Fabriciella*, as considered by Tothill (Can. Ent., LVI, 1924:257-269) and Rowe (Ann. Ent. Soc. Am., XXIV, 1931:643-678), includes twenty-eight nearctic species. On the whole, the species are quite similar in general appearance, but in most cases readily separated, in the male sex at least, by genitalic characters. Townsend (Manual of Myiology, Part III, 1936) has referred six of the species included by the above mentioned authors to restricted genera in the tribes Tachinini and Metopotachinini. The characters listed to distinguish these forms, however, are slight and seemingly of doubtful generic value. As characterized in the recent revisional papers, the present genus includes the four new species described below. Types of the latter are in my collection except as indicated under the descriptions.

Fabriciella actinosa n. sp.

Related to *F. latifacies* Toth., but readily distinguished by the much wider front, thickly haired parafrontals and presence of two pairs of proclinate orbitals in the male.

Male.—Front prominent at base of antennae as viewed from the side, width at vertex fully twice the length of second antennal segment; parafrontals yellowish gray becoming blackish toward vertex, beset with numerous coarse suberect hairs and scattered bristles outside of frontal rows; median vitta dark red, narrower than one parafrontal; verticals (two pairs) anl ocellars well developed; frontal bristles of moderate size, diverging sharply beneath antennae and stopping shortly below base of second antennal segment; face concolorous with front, its ridges flat and bare, oral margin strongly protuberant; parafacial clothed with black hairs except along inner margin, width on lower part obviously exceeding length of second antennal segment; antennae black, apex of second and base of third segments tinged with red, the latter broadly rounded at apex and a trifle shorter than second segment: arista, short and thickened almost to tip, bare, middle segment elongate and basal one about as wide as long; vibrissae stout, decussate, situated slightly above oral margin; proboscis moderately slender, hardly equal the height of head; palpi yellow, slender and not at all thickened apically; cheek pollinose on reddish ground color, about two-thirds the eye height and bearing rather sparse black hairs on lower half; back of head thickly clothed with pale yellowish pile.

Thorax subshining black with a reddish tinge in the ground color extending from notopleura to postalar calli, scutellum wholly red; notum lightly dusted with bluish white pollen, which is inconspicuous except in a flat rear view. Chaetotaxy: dorsocentral 3, 4; acrostichal 3,2 (none immediately behind suture); humeral 6; posthumeral 3; presutural 2; notopleural 2; supraalar 3; intraalar 3 (anterior one well behind suture and rather weak); sternopleural 2, 1; pteropleural 2 (as large as sternopleurals); scutellum with four lateral (basal and

[1]Contribution No. 416 from the Division of Entomology, Texas Agricultural Experiment Station.

subapical pairs rather weak), one strong decussate apical and two pairs on disk well behind middle; propleura haired; posternum bare; calypters opaque, white with a tawny tinge.

Abdomen wholly reddish yellow, polished but with a thin whitish bloom apparent on intermediate segments when viewed in a favorable angle; first segment with a weak and second with a stout pair of median marginals; third bearing a marginal row of 12 or 14; fourth segment with several irregular rows on apical third above; sternites exposed, beset with long black hairs; genital segments blackish and not very prominent; forceps arched in profile, flattened and concave on hind side, tapering rapidly before apex to an acute tip; accessory plate shining brown, terminating in an inwardly bowed pointed process; fifth sternite narrowly cleft hardly to middle, yellowish basally the lobes darker, with numerous long black hairs.

Legs stout, shining black; mid tibia with three or five strong bristles on outer front side; claws and pulvilli slightly longer than apical tarsal segment; hind tibia bearing about four stout bristles on outer posterior side and showing a faint reddish color beyond middle.

Wings gray hyaline tinged with yellow along costal margin near base; bend of fourth vein with a distinct fold and sometimes a short stump; first posterior cell narrowly open at costa far before wing tip; third vein bearing four to six setules at base; costal spine small.

Female.—Frontal width at vertex exceeding twice the length of second antennal segment; cheek three-fourths eye height; palpi slender as in male and about equal the width of parafacial; abdomen broader and more robust, anal segment bearing only two rows of bristles above on apical third; genital segments blackish and retracted, hind margin of first with a fringe of long black hairs; sternites bearing well developed bristles; fore tarsal segments broad and somewhat flattened, tibiae distinctly reddish; claws and pulvilli a trifle shorter than in male.

Length: Male, 15.5 mm.; female, 17 mm.

Holotype: Female, Alamosa, Colorado, August 2, 1934 (M. T. James); in the Colorado State College Collection.

Paratype: male, same data; in my collection.

Fabriciella egula n. sp.

Similar to the preceding species except as follows: Male frontal width at vertex barely twice the length of second antennal segment; parafrontals and parafacials cinereous pollinose, the former bearing only scattered short black hairs outside of frontal rows; antennal segments one and two wholly reddish; parafacial at narrowest width hardly equal the length of second antennal segment, clothed with fine pale hairs intermixed with black on upper extremity (one specimen showing several black hairs on lower part also). Thorax black, lightly dusted with grayish white pollen; notum subshining but the best preserved specimen showing four indistinct dark stripes in front of suture; humeri yellow in ground color. Abdomen distinctly pollinose on basal margin of intermediate segments; genital segments blackish, moderately prominent; forceps rather narrow, bowed in profile, hind surface flattened and slightly concave before

the blunt or rounded apex, accessory plate shining yellow, the process slender and pointed; fifth sternite yellow, its rather shallow cleft broadly U-shaped, the lobes bearing numerous long bristly hairs. Tibiae obscurely reddish; claws and pulvilli equal the combined length of last two tarsal segments.

Length: 14 mm. Female unknown.

Holotype: Male, San Luis Val., Colorado, August 10, 1930, without collector's label received from Dr. Hal Parks.

Paratypes: Male, Adrian, Oregon, July 22, 1934 (Chas. H. Martin).

Fabriciella nigella n. sp.

In Tothill's key (Can. Ent., LVI, p. 260) traces to *piceifrons* Tns., but at once distinguished by the presence of orbitals in the male and by the structure of the genital forceps.

Male.—Front at vertex about equal the eye width; parafrontals blackish and subshining in direct view but with thin gray pollen extending to vertex becoming denser on anterior part; frontal vitta reddish, wider than one parafrontal on upper half; antennae black, with a reddish tinge basally; arista velvety black, second segment about one-fifth as long as third, which tapers gradually outward beyond middle; frontal and ocellar bristles of moderate size; verticals two pairs, the inner strong and reclinate; parafacials gray pollinose, sparsely clothed with black hairs, distinctly narrower than width of third antennal segment; vibrissae strong and decussate, slightly above oral margin; proboscis rather slender and about equal the height of head; palpi brownish to yellow, moderately spatulate; cheek gray pollinose, beset with coarse black hairs, about two-fifths eye height; back of head thickly clothed with pale yellowish white pile.

Thorax shining black with a reddish tinge in the ground color of the postalar calli; notum polished but with thin whitish pollen apparent before the suture in a favorable light; chaetotaxy as in *actinosa;* propleura haired; calypters opaque, tawny; prosternum bare.

Abdomen shining black; second segment with a pair of stout median marginals; third bearing a marginal row of ten strong bristles; fourth with a row of discals far behind the middle besides the usual marginal row; genital segments rather small, not prominent; forceps with the beak prominent or projecting in profile, basal half strongly arched and thickly clothed with black hairs, tip of beak subtruncate in rear view; accessory plate partially exposed, bearing several delicate hairs near base of process, which is short and rather inconspicuous; fifth sternite shining black, with a shallow narrow apical incision, lobes clothed with long slender black hairs.

Legs moderately stout, shining black the knees and tibiae tinged with red; middle and hind tibiae strongly bristled; fore claws and pulvilli a little longer than last tarsal segment.

Wings gray hyaline with a distinct yellow color basally; hind cross vein strongly oblique and bicurved; last section of fifth vein almost one-half the length of preceding section; first posterior cell open far below wing tip; costal spine small; epaulet infuscated.

Length, 13.5 mm. Female unknown.

Holotype; Male, Dillon, Montana, July 16, 1934 (Dorothy Martin).

Fabriciella tahoensis n. sp.

A robust species with broad parafacials as in *latifacies*, but the abdomen is wholly black and lightly dusted with whitish pollen on basal margin of intermediate segments; mesonotum grayish pollinose, at most subshining.

Female.—Width of front at vertex one and one-half to nearly twice the length of second antennal segment; parafrontals gray pollinose becoming blackish and subshining toward vertex; median vitta red, narrower than one parafrontal except on upper extremity; verticals and orbitals two pairs, stout; ocellars well developed, proclinate; frontals beneath base of antennae diverging strongly towards eye; parafacial gray pollinose on yellow ground color, narrowest width distinctly exceeding length of second antennal segment, beset with coarse black hairs and usually with some finer pale ones intermixed; cheek concolorous with parafacial, nearly three-fourths the eye height, clothed with mostly black hairs; vibrissae stout and decussate, situated well above the projecting front edge of oral margin; antennae reaching lowest third of face, proximal segments reddish, third largely black with the apex evenly rounded; arista bare, black, middle segment about one-sixth the length of third, which is thickened on basal two-fifths; proboscis hardly equal the height of head; palpi reddish yellow, not thickened apically, beset with black bristly hairs; back of head gray pollinose and thickly clothed with pale hairs.

Thorax black, scutellum and posterior calli tinged with red; chaetotaxy as in *actinosa;* prosternum bare; propleura clothed with fine black hairs; calypters opaque, white with a yellowish tinge along outer margin of hind lobe.

Abdomen shining black; first segment without median marginal bristles, second bearing one stout pair; third with a marginal row of 10 or 12 strong bristles; fourth with a discal and a marginal row; genitalia black, retracted, posterior margin of apical segment fringed with long black hairs.

Legs black, tibiae showing a faint reddish tinge; claws and pulvilli almost equal the length of apical tarsal segment; middle tibia with 3 to 5 strong anterodorsal bristles; hind tibia bearing 4 or 5 stout uneven bristles on outer posterior side.

Wings grayish hyaline tinged with yellow along costa and at base; fourth vein with an almost rectangular rounded bend, thence strongly concave and straight to margin; third vein setulose at base; first posterior cell open far before extreme wing tip; costal spine vestigial; epaulets infuscated.

Length: 13 to 16 mm. Male unknown.

Holotype: Female, Tahoe Lake, Nevada, October 5, 1935 (A. J. Basinger); in U. S. National Museum.

Paratypes: 10 females, same data as holotype; in A. J. Basinger's collection.

The wide parafacials and pollinose mesonotum at once distinguish the species from the allied wholly black forms. The pollen on the intermediate abdominal segments is variable; sometimes extremely thin and visible only in a flat rear view.

NOTES ON LITTLE KNOWN NEW ENGLAND SPIDERS.

BY B. J. KASTON,
New Haven, Conn.

I am indebted to the Connecticut Geological and Natural History Survey through Dr. W. E. Britton, its Superintendent, for the facilities which make this study possible. I wish to thank Miss E. B. Bryant of the Museum of Comparative Zoology and Dr. W. J. Gertsch of the American Museum of Natural History for allowing access to material in their respective collections as well as for kind aid and advice.

OONOPIDAE

Orchestina saltitans Banks.

Orchestina saltitans Banks, 1894, Ent. News, V:300, ♀.
Orchestina saltitans Petrunkevitch, 1920, J. New York Ent. Soc., XXVIII: 157, pl. ix, f. 1-9, ♂.
not *Orchestina saltitans* Emerton, 1909, Trans. Conn. Acad. Sci., XIV: 214, pl. i, f. 4-4b.

Comte de Dalmas in his 1916 revision of the genus *Orchestina* questioned the identity of Emerton's specimen. I have seen the specimen at the Museum of Comparative Zoology and am able to state definitely that it is not an *Orchestina*. At the time of Petrunkevitch's paper the species was known only from his single male from New Jersey and Banks' single female from Long Island, N.Y. From Dec. 18, 1934 to Oct. 24, 1937 inclusive, a total of 23 specimens of both sexes were collected by the author and his wife at various intervals in several different buildings in New Haven, and a specimen was found in a steel bank vault at Meriden, Conn., Sept. 25, 1937 by H. L. Johnson. The species is much more common than generally supposed but on account of its minute size is easily overlooked. None have been found out of doors.

THERIDIIDAE

Latrodectus mactans (Fabricius).

Aranea mactans Fabricius, 1775, Systema Entomologiae, etc., p. 432, No. 4.
Aranea mactans Fabricius, 1793, Entomologia Systematica, etc., II: 410, No. 11.
Latrodectus mactans mactans Chamberlin & Ivie, 1935, Bull. Univ. Utah, XXV (8): 13.

A complete list of New England records with map is given by the author in the October 1937 issue (Number 85, pp. 1-11) of the Bull. New England Mus. Nat. Hist. It is of interest to note in this connection that Massachusetts is stated by Chamberlin and Ivie to be the type locality for this species. However, after checking against the original description I am unable to confirm this statement. I wish also to correct some errors of citation of the original description which have appeared in the very considerable literature that has accumulated on this species in recent years. Most authors simply copy the error from existing lists and catalogs instead of looking up the original, which, of course, may not be accessible to them. The titles of Fabricius' two works listed above are such as to be easily confused, and the usual mistake is to associate the 1775 date with the title, volume, page, and species number of the 1793 work. The description in the latter work is practically a verbatim copy of that in the earlier.

CLUBIONIDAE

Marcellina piscatoria (Hentz).

Figs. 4, 7 and 11

Clubiona piscatoria Hentz, 1847, J. Boston Soc. Nat. Hist., V: 450, pl. xxiii, f. 15, ♂ (juv. ?).
Anyphaena piscatoria Simon, 1897, Hist. Nat. Ar., II: 95.
Marcellina piscatoria Bryant, 1931, Psyche, XXXVIII: 104, pl. vi, f. 1-2, ♂.

The *female* is here described for the first time.

nadian Ent. v. 70 no. 1 Jan. 1938.

ERRATA

Certain typographical errors in the January number to which Mr. B. J. Kaston has called our attention should be corrected as follows:

p. 12, 2nd line in synonymy of *Latrodectus mactans* Fabr. should read,

Aranea mactans Fabr. 1793, Entomologia Systematica, etc., II: 410, No. 11.

p. 12, 2nd line in synonymy of *Marcellina piscatoria* Hentz should read,

Anyphaena piscatoria Simon, 1897, Hist. Nat. Ar. II: 95.

Total length 8.2 mm. Carapace 3.85 mm. long, widest between 2nd and 3rd coxae, where it is 3.2 mm. and narrowed to 2.3 mm. at clypeus; highest in front of rather deep dorsal groove. Carapace yellowish brown, darker towards anterior end, reddish in eye region, thinly covered with fine black hairs longer in eye region.

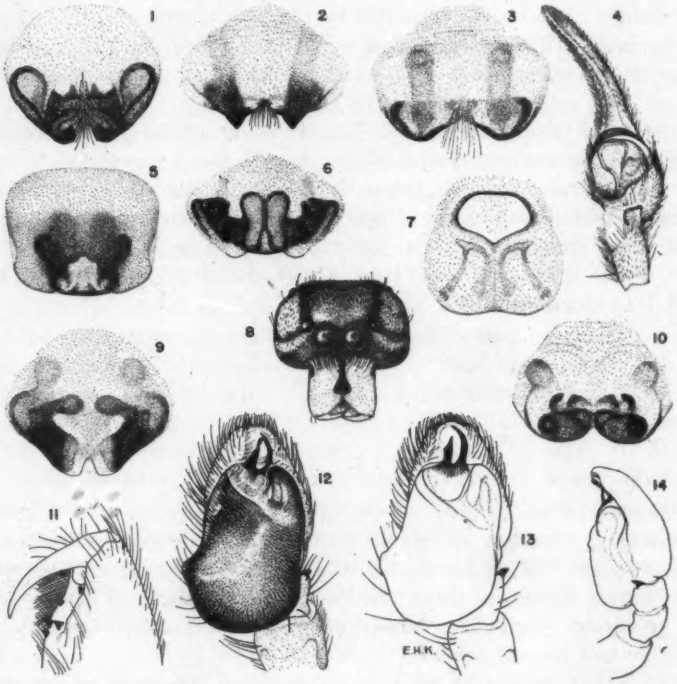

Fig. 1. *Pirata piratica*, epigynum. 2. *Pirata arenicola*, epigynum. 3. *Pirata maculatus*, epigynum. 4. *Marcellina piscatoria*, left palpus; ventral aspect, hence somewhat foreshortened. 5. *Pirata marxi*, epigynum. 6. *Pirata montanus*, epigynum. 7. *Marcellina piscatoria*, epigynum. 8. *Dendryphantes virginis*, front view of cephalothorax. 9. *Pirata minutus*, epigynum. 10. *Pirata insularis*, epigynum. 11. *Marcellina piscatoria*, distal portion of left chelicera of male, retrolateral aspect. 12. *Dendryphantes virginis*, left palpus, ventral aspect. 13. *Dendryphantes flavipedes*, left palpus, ventral aspect. 14. *Dendryphantes virginis*, left palpus, retrolateral aspect.

Eyes in two rows, ratio as follows: AME : ALE : PME : PLE = 18 : 16 : 13 : 14. First row slightly recurved, the AME separated by not quite their diameter (16 : 18) and from the apparently oval ALE by about 1/3 their diameter. Second row broader than first, slightly procurved, the medians separated by less than two diameters (23 : 13), slightly nearer the laterals (21 : 23). Median ocular area slightly wider than long, narrowed behind (49 : 52). Laterals of each side separated by about 1/3 their diameter.

Height of clypeus 2/3 diameter of AME. Chelicerae with boss, reddish brown, somewhat porrect, 2.2 mm. long. Fangs long and thin, overlapping each other. Promargin with well developed scopula; with three teeth, widely spaced,

the outer two about same size, the innermost much smaller. Retromargin with two, widely spaced, about same size as outer two on promargin. Maxillary endites parallel, wide in front, slightly indented on lateral face, with well developed scopula. Labium longer than broad (57:52), extending beyond middle of maxillae; provided with basal lateral excavations. Sternum triangular, longer than wide (40:15), yellowish except for border, which is reddish brown like labium and endites. Hind coxae separated by 1/3 their length. Legs 14 23, colored like the sternum. Tibial index of first leg 11.4, of fourth leg 12. Trichobothria numerous on tibiae, metatarsi, and tarsi. Claw tufts poorly developed. No scopulae.

Spines (all short) as follows: Leg I, femur dorsal 1-1, prolateral 1-1; tibia ventral 1p; metatarsus ventral 2-2-1. Leg II like I except for femur having only 1 prolateral. Leg III, femur dorsal 1-1, prolateral 1d, retrolateral 1d; tibia dorsal 1, prolateral 1-1, retrolateral 1-1, ventral 1p-1p; metatarsus dorsal 1, prolateral 1-1-1, retrolateral 1-1-1, ventral 2-2-2. Leg IV, same as III but lacks the dorsal spine on tibia. Palp, femur dorsal 1-1, prolateral 1d; tibia prolateral 1-1; tarsus prolateral 1, ventral 1-1.

	Femur	Pat.+Tib.	Metatarsus	Tarsus	Total	
I	3.35	5.15	3.44	1.68	13.62	mm.
II	2.86	4.05	2.73	1.47	11.11	mm.
III	2.60	3.28	2.52	1.05	9.45	mm.
IV	3.70	4.64	3.78	1.35	13.47	mm.
Palp	1.68	1.89		1.51	5.08	mm.

Abdomen brown to gray above, lighter on venter, covered with a fine black pubescence. Anterior spinnerets stouter than posterior, and shorter. Posterior spinnerets of two segments, the basal longer than the apical (40:25) and thicker. Median spinnerets about the thickness and length of the apical segment of posterior. Epigynum large, occupying entire interpulmonary space: opening large and pointed behind (figure 7).

Male. Size, color, and structure in nearly complete agreement with the female. The chief difference concerns the eye relationships. Ratio of AME: ALE: PME: PLE = 17:12:10:10. Median ocular area slightly longer than wide. Chelicerae slightly longer in proportion than in female. Promarginal teeth with middle one the largest. Retromarginal teeth with outer one smaller than inner.

Legs with more spines than in female. First leg 15.56 mm. long, tibial index 9.7. Second leg 12.28 mm. Third and fourth legs about same length as in female. Tibial index of fourth leg 11.6. Apical segment of posterior spinnerets longer in proportion than that of female.

Palpus with femur curved and longer than the tibia plus patella. Tibia slightly longer than patella and bearing a flat, truncate apophysis. Tarsus longer than femur, the palpal organ occupying only the proximal third, but with the embolus continuing in a groove to the extreme tip (fig. 4).

This genus, erected by Miss Bryant (1931) for *piscatoria*, the only known species, was included by her in the Anyphaenidae. However, the position of the tracheal spiracle is such as to exclude it from that family. It belongs in the

Clubioninae. Two other genera of this subfamily have representatives in New England. In having the anterior median eyes the largest, the first legs longer than the fourth, as well as longer, thinner, posterior spinnerets, *Marcellina* can be distinguished from *Clubiona*. *Cheiracanthium*, which also has the first legs longer than the fourth, differs from *Marcellina* in lacking a thoracic groove, having the eyes subequal, and the posterior medians nearer to each other than to the laterals.

Records: A ♂ in the penultimate instar, Redding, Ct., 3 May 1935 (Elizabeth Kaston) matured 12 May. ♀, 16 June 1935, Portland, Ct. (B.J.K.). ♀, Southbury, Ct., Aug. 1936 (T. Loosanoff). Several males and females in the penultimate instar, 8 May 1937, North Stamford, Ct. (B.J.K.), matured 12-18 May. On July 4, 1937 the North Stamford locality was visited again. No males were found but two females were found guarding their egg sacs. In the American Museum of Natural History are a male and female from Jackson County, Florida, 12 April 1935 (H. K. Wallace), and a female from Giles Co., Fla., 26 July 1935 (J. D. Kilby).

In life the cephalothorax and legs have a translucent grey appearance. The abdomen is a glistening, silky brown to orange, with a darker hastate mark over the heart, somewhat as figured by Hentz. I have not seen any in which the body is piceous as described by Hentz. I found them in thin silken bags on the under side of stones of an old wall near a stream. They make no attempt to escape but feign death when disturbed.

In the laboratory copulation was observed on two successive days with one pair, the female tolerating the presence of the male in an adjacent silk bag between matings. There were practically no preliminaries, the position assumed being similar to the Lycosid type. As has been noted in other families, there was a rise and fall of the leg spines during distention and collapse of the hematodocha.

CTENIDAE

Zora pumila (Hentz).

Katadysas pumilus Hentz, 1850, J. Boston Soc. Nat. Hist., VI: 287, pl. x, f. 16, ♂ (juv. ?).
Zora spinimana Emerton, 1911, Trans. Conn. Acad. Sci., XVI: 403, pl. v, f. 5-5b, ♀. (not *spinimana* Sundevall).

A comparison with European specimens indicates that American specimens referred to *spinimana* (Sundevall) really belong to *pumila*. Furthermore, in the M.C.Z. collection there are females and juveniles from Massachusetts labeled *spinimana* which agree in every respect with a penultimate male from Auburn, Ala., (N. Banks Coll.) labelled *pumila*. At the Amer. Mus. Nat. Hist. are specimens from various localities extending north as far as Ramsey, N.J. A female with eggs was collected by the writer at Killingworth, Conn., June 23, 1935.

LYCOSIDAE

Lycosa modesta (Keyserling).

Tarentula modesta Keyserling, 1876, Verh. zoo. bot. Ges. Wien, XXVI: 626, pl. i, f. 11, 12, ♂ ♀.
not *Lycosa modesta* Chamberlin, 1908, Proc. Acad. Nat. Sci. Philadelphia, LX: 268

Of this southern species the Amer. Mus. Nat. Hist. has specimens collected from as far north as Long Island. Records for Connecticut include: New Haven, summer of 1932 (B.J.K.). Westport, 26 May 1935 (B.J.K.).

Pirata maculatus Emerton.

Figure 3.

Pirata maculatus Emerton, 1909, Trans. Conn. Acad. Sci., XIV: 209, pl. vi, f. 10-10b, ♀.
Pirata arenicola Gertsch, 1934, American Mus. Nov., 693: 11 (in part).

Though relegated to the synonymy by him in 1934, Dr. Gertsch now agrees that this is a valid species. The epigynum (fig. 3) is intermediate in appearance between that of *P. arenicola* Emerton (fig. 2) and *P. insularis* Emerton (fig. 10) and appears to be quite constant in numerous Connecticut specimens examined.

Because of the confusion over synonymy in this genus and as an aid to the identification of the females I have supplied drawings of the epigyna of the four other New England species. They include *marxi* Stone (fig. 5), *minutus* Emerton (fig. 9), *montanus* Emerton (fig. 6), and *piratica* (Clerck) (fig. 1).

OXYOPIDAE

Oxyopes salticus Hentz.

Oxyopes salticus Hentz, 1845, J. Boston Soc. Nat. Hist., V: 196, pl. xvi, f. 10, ♀.

This species, predominantly southern in its distribution, has not heretofore been recorded north of Long Island, N.Y. Records for Connecticut include: Amston, 24 June 1918 (E. B. Bryant). Norwalk, May and June 1933 (W. J. Gertsch). West Haven, 2 July 1936 (M. B. Bishop). South Meriden, 3 July 1937 (H. L. Johnson). Mt. Carmel, 3 Aug. 1937 (K. Sommerman).

ATTIDAE

Pellenes calcaratus Banks.

Pellenes calcaratum Banks, 1904, J. New York Ent. Soc., XII: 117, pl. vi, f. 17, 19, ♂ ♀.

This species has been known only from Florida, Georgia and Tennessee. A male taken during the summer of 1932 at Westville, Conn. (B.J.K.).

Phidippus insolens (Hentz)

Attus insolens Hentz, 1845, J. Boston Soc. Nat. Hist., V: 200, pl. xvii, f. 8, ♂.
Phidippus insolens Peckham & Peckham, 1909, Trans. Wisconsin Acad. Sci., XVI: 400, pl. xxx, f. 2-2d, ♂ ♀.

This species has been known from the western and southern states. The following records from Connecticut tend to establish the authenticity of a Long Island, N.Y. record on which the Peckhams had cast doubt.

Records: Westville, 22 May 1933 (J. C. Beakley). Brooksvale, 22 May 1935 (B.J.K.). Storrs, Oct. 1935 (J. A. Manter). Branford, 16 June 1937 (B.J.K.). Brooksvale, 17 June 1937 (D. S. Riggs). Union, 25 June 1937 (B.J.K.). Mt. Carmel, 1 Aug. 1937 (B.J.K.).

Dendryphantes virginis Chamberlin

Figures 8, 12 and 14

Dendryphantes virginis Chamberlin, 1925, Bull. Mus. Comp. Zool., LXII: 233, ♂.
Dendryphantes flavipedes Emerton, 1913, Bull. American Mus. Nat. Hist., XXXII: 259 (in part), pl. xlviii, f. 10, ♂.
not *Dendryphantes flavipedes* Peckham, 1889, Trans. Wisconsin Acad. Sci., VII: 42, pl. iii, f. 29a, ♂.
nor *Dendryphantes flavipedes* Emerton, 1909, Trans. Conn. Acad. Sci., XIV: 226, pl. xi, f. 4-4a, ♂.

Chamberlin established this species, for material collected in Maryland and Virginia, on the basis of the male palpal organ. The embolus is furcate as in *flavipedes*, but the ectal, or retrolateral, ramus is thinner than in *flavipedes*. Undoubtedly the drawing in Emerton's 1913 paper is of *virginis*, though in

looking over type and other material at the M.C.Z., as well as my own, I could find none with the ramus as thin as he figured it. For comparison I have included a drawing of each species (figures 12 and 13). It can be seen from these that there are other slight differences as well.

From Emerton's (1913) remarks it would appear that he had both *flavipedes* and *virginis* under consideration from New Jersey. I find that in *flavipedes* there is a tuft of white scales between the large eyes; the legs are mostly yellowish, (except for the last pair which is brown), and in some cases provided with a black line on the prolateral surface of the femora; and the abdomen has an indistinct chevron pattern. In *virginis* the white tuft between the large eyes is lacking; the legs are more brown than yellow and without black lines; and the abdomen has in the posterior half three pairs of black spots. The chelicerae are light yellow except for a black basal spot on each side and a black stripe along the median line which widens distally to form a characteristic mark (figure 8). In *flavipedes* the chelicerae are darker, and though there may be a black stripe along the median line, there does not seem to be as distinct a mark distally.

Record: East Hampton, Conn., 7 May 1937 (A. De Caprio).

NEWS AND VIEWS

INSECT PESTS IN NUMBERS THREATEN FOR NEXT YEAR

Insect pests are ending their season with serious threat of large numbers next year in many places according to the Insect Pest Survey Bulletin of the U. S. Department of Agriculture.

Grasshopper eggs in the large numbers expected are revealed by surveys in most of the States where hopper outbreaks were heavy last summer. Because of warm weather, egg laying has been somewhat protracted in the southern part of the grasshopper-ridden area.

Mormon cricket eggs are numerous in the northern part of Nevada, where the egg survey has been completed, but less so southward in Montana. Apparently the crickets have spread from focal points scattered over much of the State.

The hessian fly has been found in some early seeded wheat in Missouri and in southeastern Kansas.

The chinch bug took advantage of the dry, warm fall weather to enter hibernation in tremendous numbers.

The velvetbean caterpillar, which feeds on soybeans, cowpeas, peanuts, etc. recently has been very numerous and destructive in Florida. It is at work also in Louisiana.

The apple maggot showed up in unexpectedly large numbers for the first time in 10 years in an orchard in central West Virginia.

Unusually large numbers of the grape berry moth occurred along Lake Erie in Ohio and in southwestern Michigan.

The walnut husk fly has extended its infestation somewhat to the west, having been found in Orange County, California.

The California red scale is injuring severely citrus trees in the southern tip of Texas. It also is abundant in Los Angeles County, California.

The vegetable weevil, which had temporarily suspended operations in the Gulf States, is attacking truck crops there.

The northern mole cricket has been seriously damaging potato tubers in Massachusetts—an extraordinary occurrence so far north.

The squash bug seems to be more numerous than usual in Minnesota and Iowa.

Larvae of the spotted cucumber beetles have injured immature peanut pods in Virginia.

The tobacco worm continued its depredations late into the fall, being specially destructive in Connecticut.

The late season has been very favorable for boll weevil development. Many more weevils than have been found for several years are reported from South Carolina, Georgia, Florida, Mississippi, Louisiana, and eastern Texas. They have continued to develop in the late growth of cotton squares and young bolls produced by recent abundant rains.

BRITISH SCIENTIFIC SOCIETY HONORS AMERICAN ENTOMOLOGIST

Robert E. Snodgrass, U. S. Department of Agriculture entomologist, has been elected an honorary fellow in the Royal Entomological Society of London—the third American to be so honored in recent years. Honorary membership in this society—one of the oldest entomological societies in the world—is limited to twelve, all elected for their contributions to the scientific study of insects. Dr. L. O. Howard, one of the great pioneers in economic entomology, and the late Professor W. M. Wheeler of Harvard University, the world's foremost authority on ants, were also recipients of this honor.

Mr. Snodgrass was elected because of his important morphological work on insects. His extensive research on the comparative anatomy of insects has made it possible to establish many important and interesting relationships among the various insect groups, according to Lee A. Strong, Chief of the Bureau of Entomology and Plant Quarantine. Although all this is in the realm of pure science, the results have been of great practical value in leading to a better understanding of insect mechanism and in furnishing a basis for physiological studies, thus facilitating the work of the economic entomologists seeking better methods for controlling insect pests.

THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

The regular monthly meeting of the Montreal Branch was held in the Lyman Room of the Redpath Museum, McGill University on Saturday evening, December 11th, 1937. Mr. H. A. U. Monro gave an account of the very successful annual meeting of the parent society held in Toronto, November 18th and

19th. Mr. G. A. Moore was congratulated on his election as a Fellow of the Royal Entomological Society of London.

The meeting was then addressed by Mr. Eugene Munroe on "Collecting Lepidoptera in the West Indies and British Guiana during 1937." Mr. Munroe gave a very interesting account of a collecting tour which included visits to Bermuda, Dominica, St. Lucia, Trinidad and British Guiana. Mr. Munroe illustrated his address with a number of specimens of butterflies and moths and also exhibited several cases representing his collection made during the trip.

SEVERE GRASSHOPPER PLAGUE IN NICARAGUA

Nicaragua is periodically visited by plagues of grasshoppers which do considerable damage to crops, but since August of this year their ravages have been extraordinarily severe and now constitute a serious threat to the nation's agriculture and to the national economy in general, according to a report received by the U. S. Bureau of Agricultural Economics from the American Vice Consul H. Bartlett Wells in Managua. The most important crops in Nicaragua are bananas, beans, coffee, corn, rice and sugar.

On November 10th, the Government of Nicaragua promulgated a degree requiring all able bodied male inhabitants in the Republic from 12 to 50 years of age either to devote one day of 8 hours work a week to combating the pest or pay a weekly tax of 50 cents. The only men not subject to this law are foreigners with diplomatic status. The fund collected from those who choose to pay the 50 cents weekly tax will be used exclusively for fighting the insect.

Specimens of the Nicaraguan grasshoppers have been forwarded to the United States Department of Agriculture for exact identification and suggestions as to the best means for checking their increasing damage.

RESEARCH NOTES

TWO INTERESTING RECORDS OF LEPIDOPTERA FROM VANCOUVER ISLAND

During the month of August of this year serious damage was done on several seed farms near Victoria, B. C. by larvae of the moth *Heliothis phloxiphaga* G. & R. The principal injury was caused by the caterpillars eating large holes in the seed capsules of Antirrhinums and devouring the unripe seeds. The flower heads were also attacked and the total injury to these plants was approximately 70 per cent. Other plants attacked were schizanthus, asters, and, to a slight extent, sweet peas. The interesting point about this outbreak is that the moth had never before been recorded from Vancouver Island, although lepidoptera have been collected there extensively by various people for thirty or forty years. The moth was identified by Dr. J. H. McDunnough who informs me that it is well known throughout the west. Our only previous records of this species in British Columbia are from Kaslo and other points in the Southern interior of the Province but I have recently been informed by Mr. Llewellyn Jones, of Mill Bay, Vancouver Island, that he took two specimens at light in 1931.

The second occurrence of interest is the species *Hemerocampa pseudotsugata* McD., the fir tree tussock moth. This again is a species never before recorded from Vancouver Island. The first specimens were reared from two

larvae collected by Mr. Llewellyn Jones at Mill Bay in 1936 and this year a number of larvae were sent to the Victoria laboratory by a settler at Mill Bay. This is the species which occurred in outbreak numbers in the Okanagan country in 1918 and again in 1920, defoliating Douglas fir trees throughout the district and causing immense discomfort to the residents on account of the poisonous hairs from the cocoons which were frequently spun on walls or fences around dwellings. A number of moths were reared at the Victoria laboratory. These were decidedly darker in colour than specimens from the Okanagan and the markings less distinct.

The coastal strip on the east side of Vancouver Island extending from Victoria to Comox, 140 miles to the north and including the adjacent islands of the Gulf of Georgia, constitutes a faunal area distinct from the rest of the coast region. In this area the rainfall is light and, while summer temperatures are much lower than in the interior, dry periods of considerable length occur. Many species of insects typical of the dry interior are able to maintain themselves in this coastal strip, often showing colour variations from the typical form sufficiently constant for them to be designated geographical races. They do not find a congenial habitat in the wetter portions of the coast and will not be met with again until the dry interior is reached. The two species mentioned here appear to be examples of this group.

W. DOWNES.
Dominion Entomological Laboratory, Victoria, B. C.

EXTERNAL PARASITES OF BATS

In connection with some observations on bats (Life history notes and growth studies on the little brown bat, *Myotis lucifugus lucifugus*, Can. Field-Nat., 50: 114-116, 1936), a collection of the external parasites of bats was made. These have been identified through the kindness of Mr. G. J. Spencer, Department of Zoology, University of British Columbia.

The collection consisted of two species of mites (*Ceratonyssus occidentalis* and *Spinturnix* sp.), one flea (*Myodapsylla insignis*) and the bat bug (*Cimex pilosellus*).

Ceratonyssus occidentalis Ewing.—The genus was described by Ewing in 1922 and the species at a later date. My specimens are from *Myotis lucifugus* taken at Frank's Bay, Lake Nipissing.

Spinturnix sp.—The mites of this genus are all parasitic on bats, but apparently they do not seriously inconvenience the host. The young hatch with the full complement of legs, the larval stage having been passed in the mother. Several species have been described from the United States. These mites occur on the bats' wings. They are larger than those of the preceding species. My specimens were identified by H. E. Ewing. A closely related genus *Periglischrus* occurs on foreign bats. Specimens off *Myotis lucifugus* from Frank's Bay, Lake Nipissing and Laird, Algoma District, Ontario.

Myodosylla insignis Roths.—The family to which this species belongs is confined to bats. This species was described by Rothschild in 1903, the type having come from a bat *Myotis lucifugus* from Ontario. My species were from *Myotis lucifugus* taken at Frank's Bay, Lake Nipissing and Laird, Algoma

district. The specimens were determined by Dr. J. Wagner of Belgrade.

Cimex pilosellus (Horvath).—The bat bug appears to be a common parasite of *Myotis lucifugus*. They are found not only on bats but in crevices near the bats' roosts. A colony of a hundred or more bats roosted in the attic of an old house, used as a temporary laboratory at Frank's Bay, Lake Nipissing. Occasional individuals gained access to some of the rooms below, due to much of the plaster having fallen off the ceiling. It was not unusual for persons sleeping in these rooms to be bitten by the bat bugs during the night. The effect of the bite was quite similar to that described for the bed bug. The collection consists of specimens from Laird, Algoma district, Ontario, as well as from Lake Nipissing and are from *Myotis lucifugus*.

J. R. DYMOND.
Royal Ontario Museum of Zoology, Toronto.

THE EUROPEAN PRAYING MANTIS IN ONTARIO

The European praying mantis, *Mantis religiosa*, has become a rather common insect in some parts of southern Ontario. When it first reached here and from what source is not known, although it is likely that it came by way of New York State, to which Howard (The Insect Book) believes it was introduced in the egg stage on nursery stock. The number of motor cars coming into Canada from the United States provide abundant means of transportation. The capture of one at the Bay St. Docks, Toronto, in August, 1935, seems to indicate the possibility of some coming by boat.

The Museum's first record is of one seen near Cooksville in 1914 by Mr. Richard Garratt of Deseronto. Other early records are Kingston, 1920 (H. C. White and Prof. R. O. Earl), Colborne, 1921 (specimen in Museum), Green Point in 1928 (R. Garratt). Mr. Garratt also reports them as so numerous in 1930 and 1931 that he tried them out as bait for bass, omitting to state with what result, however. It was in 1933 that the insect was first seen around Toronto, six specimens having been brought to the Museum in that year, three from Toronto, one each from Kingston, Belleville and Picton. In 1935 four came from Toronto, in 1936 two from Toronto and one each from Orono and Willowdale. Increased interest was shown in 1937, when thirteen specimens were sent in and more offered.

At the present time, the Mantis appears to have settled in a belt along the shores of Lake Ontario from Colborne (?) on the west to Kingston on the east. It appears to be most numerous around Belleville, Picton and Bowmanville, from which district Mr. G. E. Bucher, who was working during the summer at the Belleville Laboratories, stated that the Mantis were collected and sent to the western provinces in an endeavour to combat the grasshopper plague, egg masses also being collected for the same purpose.

One specimen thought to be *Paratenodera sinensis* Sauss, taken at Atlantic City, has been contributed by Mr. R. Blackmore, Toronto. Dr. Howard mentions that this large and striking form has recently become acclimatized. It made its appearance about Philadelphia in 1896 and in 1900 was quite numerous. In 1933, one female *religiosa* was kept in captivity at the Museum for nearly two months.

Its principal food was grasshoppers, and its appetite was never satisfied. It finally laid a big egg mass, and shortly afterwards expired. Feeding a mantis becomes tedious. They are really interesting insects, and being of some economic value, should be welcomed into our insect life. CHAS. E. CORFE.
Royal Ontario Museum of Zoology, Toronto.

THE OCCURRENCE OF SITONA LINEATUS L. IN BRITISH COLUMBIA.

Complaints were received at the Victoria laboratory this summer of serious injury to seedling peas caused by a small grey weevil. Specimens were forwarded to the Entomological Branch for identification and the species was tentatively identified by Mr. W. J. Brown as *Sitona lineatus* L., which determination was subsequently confirmed by Mr. L. L. Buchanan of Washington. Specimens of this weevil had been taken by us the previous autumn at Royal Oak near Victoria under Codling moth bands. In Europe it is a serious pest of peas, beans, vetches, clover and alfalfa. The adult beetles feed on the leaves in a characteristic way, cutting semicircular notches, about one eighth of an inch in diameter, which are more or less evenly and closely spaced around the periphery of the leaf. The larvae feed on the roots of leguminous plants. The adults hibernate, depositing their eggs the following summer. In Germany the number of eggs per female is said to vary from a few hundreds to nearly 2000.

In the Victoria district the weevil is already quite wide-spread and abundant. The first reports were received from the city area but we subsequently took numbers of the beetles on red clover at Keeting twelve miles to the north on the Saanich peninsula. This is the first record of the occurrence of this weevil in North America. W. DOWNES.
Dominion Entomological Laboratory, Victoria, B. C.

Mailed Saturday, January 29th, 1938